District Heating & Cooling in Vienna

The “Vienna Model”

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1 Overview

Fernwärme Wien is part of the Wien Energie Group, which in turn is part of Wiener Stadtwerke Holding. Wien Energie Fernwärme has two core business areas that perfectly complement each other. One is the city of Vienna's need to dispose of waste and the other to supply Fernwärme Wien customers with heat as efficiently, cheaply and safely as possible.

This use of waste heat from generating stations fed into the district heating network, which results in a primary energy savings as well as a positive and sustainable environmental effect, is known as the ***"Vienna Model".***

1.1 History

The company was founded in 1969 under the name of Heizbetriebe Wien. The assignment by the city was to supply Vienna with district heating and to run the waste treatment plant in the Spittelau.

1978: Transport ring pipe line around the City completed.

1985: Take-over of Flötzersteig plant from the City of Vienna.

1987: Major fire in the Spittelau plant, majority of the plant destroyed

1989: The Spittelau had been completely rebuilt and started operations. The artistic design by Friedensreich Hundertwasser resulted in a high level of acceptance.

1999: More than 200,000 private customers

2000: Integration of the special waste and sewage treatment incineration plant Simmeringer Haide

2002: Wien Energie "Wedding". Merger of the energy companies of the City of Vienna. (Electric power, gas, district heating). New image under the brand name of Wien Energie.

2005: Transport network reaches 1,000 km landmark.

2006: Third party certification of Simmeringer Haide plant.

2007: Start of Business Area District Cooling. Launch of operations of the district cooling system of the development project "Town Town".

2007: Third party certification of Flötzersteig waste treatment plant.

2008: Grand opening of the third waste treatment plant in Vienna: the Pfaffenau - operated by Fernwärme Wien.

2009: joint certification of all waste incineration plants in respect to environment, quality, safety and EMAS II (eco-management and audit system).

2 Description of the system

The "Vienna Model" ensures that the waste (approx. 900,000 tonnes in the previous year), with great effort going into flue gas purification, is disposed of along with the best possible

utilisation of the waste heat. Fernwärme Wien has considerable know-how in the construction of district heating systems and heat distribution as well as the associated services such as metering, billing, plant service and maintenance, plant optimisation and much, much more.

2.1 Heating Production

During the 2007/2008 fiscal year, Fernwärme Wien delivered approximately 5,636,000 MWh of heat to its customers. In all, 95.9% of this came from waste heat sources. The heat resulting from power generation and waste incineration, for example, continues to serve the city in the form of district heating for schools, museums, government buildings, hotels, offices and homes.

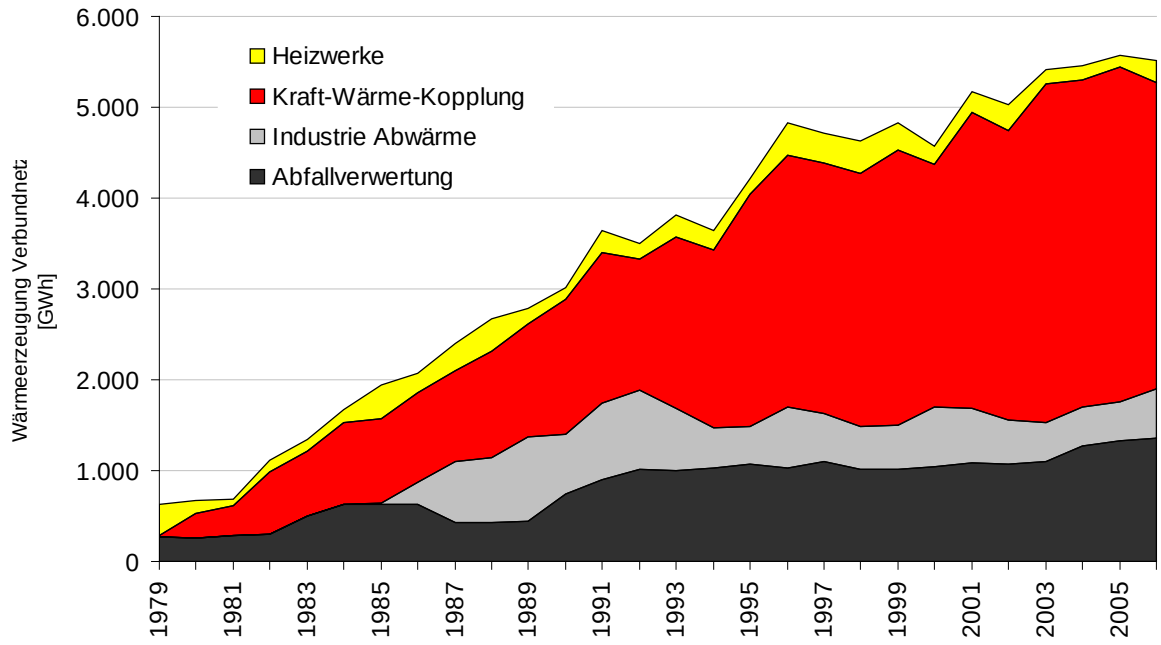


Illustration 1: The development of district heating in Vienna in 2006

In Vienna, district heating is accomplished through the environmentally friendly and economic processes of waste incineration heat recovery and the consistent use of combined heat and power (CHP) generation. The base load is met by the thermal waste processing plants (Spittelau, Flötzersteig, Pfaffenau and Simmering) as well as through industrial feeds such as OMV, Henkel Austria and Hrachowina. The base load share from these plants amounts to 27 % of heat generation.

In contrast to heating, electricity is a high-cost form of energy that is complicated to produce and results in significant heat losses. In the case of combined heat and power, it is precisely these thermal losses that are available to provide consumers with heat. This increases efficiency, or in this case fuel efficiency, resulting in better utilisation of fuel resources. Currently, this high-efficiency CHP accounts for approximately 68 % of total heat production. Among these is a biomass CHP with a capacity of about 37 MW — Austria's largest biomass CHP by any measure. In total, Wien Energie Fernwärme has the capacity to generate up to 2,830 MW of district heating. The maximum load in the company history was generated on January 24, 2006 with 2,308 MW.

This energy is used to heat the water in the network, which is then pumped with a minimum of energy expended to consumers throughout Vienna. Losses do result from the transport of heat from the production plants to the customers. These losses are a measure of the quality and operation of the district heating network. The lower these losses are, the higher the efficiency of district heating. The net losses are determined from the difference between the heat produced and heat sold. The losses are presented here as a percentage of the total heat production. See the following graph.

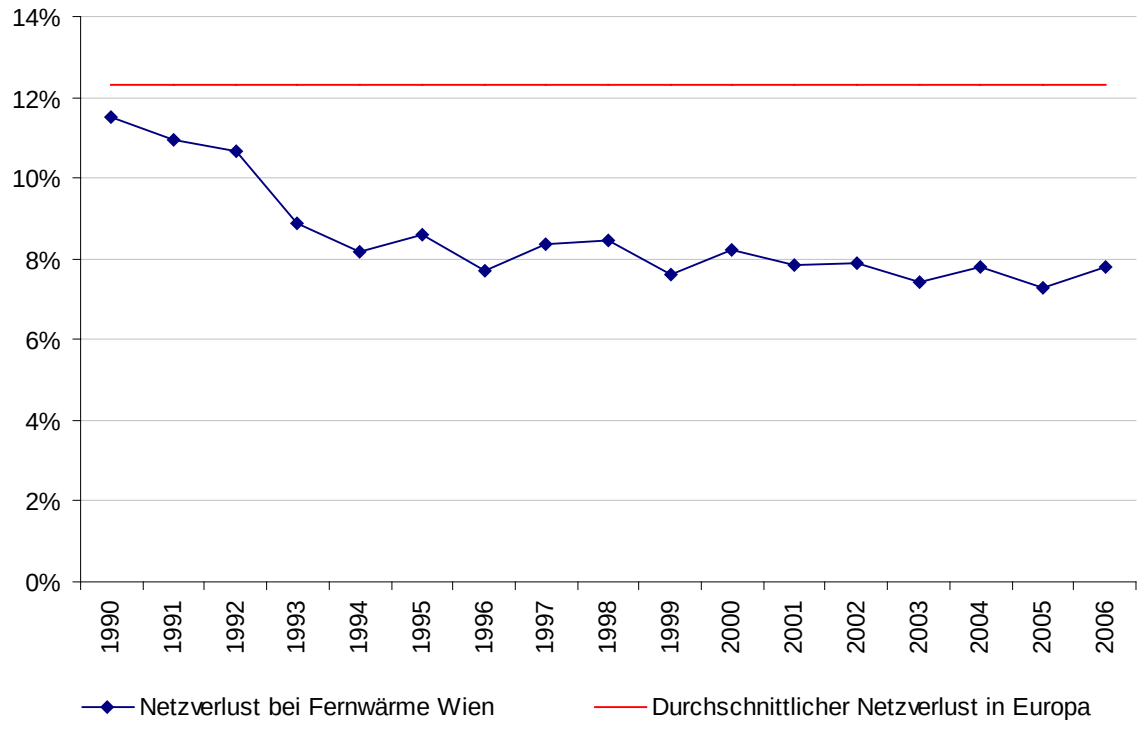


Illustration 1: Network losses for Fernwärme Wien

3 Environment and climate

In 1999, Vienna City Council adopted a climate protection programme (KLIP). Relevant measures decided for electric power and district heating are the modernisation of the co-generation plants and the promotion of renewable sources of energy. The expansion of the thermal waste treatment plants is an important measure to reduce CO2-emissions. The urban energy efficiency programme consisting of a set of more than 100 specific measures was started in 2006. The programme focuses on the improvement of the efficiency of the power plants and on getting more awareness for energy saving by the consumers.

When looking at which facility the heat is produced at, one can see that up to two-thirds comes from plants using fossil fuels, such as the Wienstrom CHP, which primarily uses gas to produce electricity. Regarding the amount of fuel required, we can see that through the use of waste heat from power generation only a small fraction of the fuel actually goes into producing heat. Thus, the portion of fossil fuels used drops to 30%! Calculated in accordance with the European standard EN 15603, the resulting primary energy factor for Vienna is 0.26, which means only 0.26 MWh of fuel are used to provide the customer with 1 MWh of heat. A gas-heating stove, by comparison, needs about 1.4 MWh of fuel.

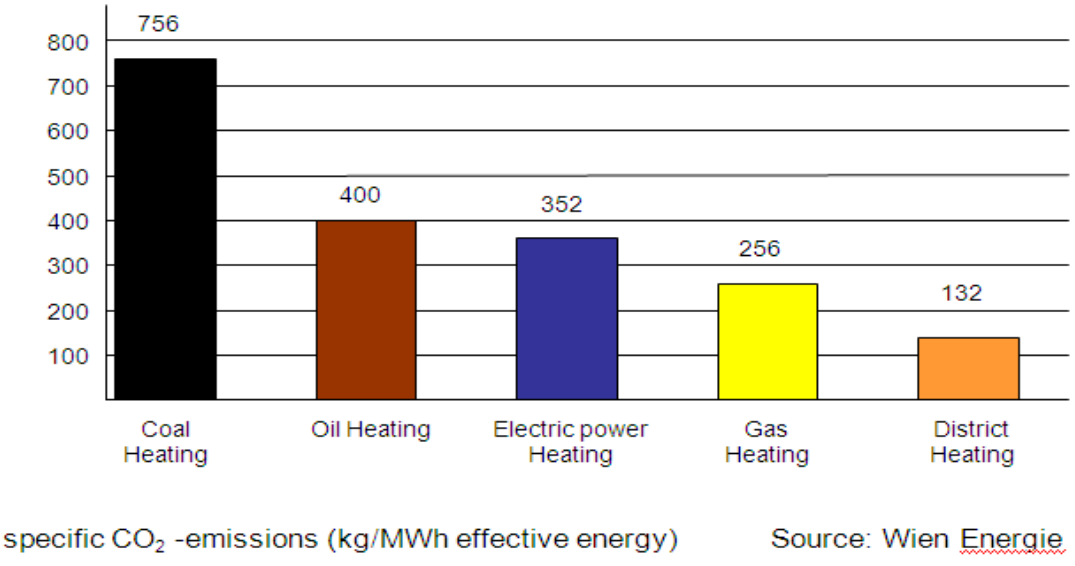


Illustration 2: Comparison of CO_2 emissions per MWh of various heating systems

This primary energy consumption is also reflected in the resulting emissions.

The most convincing arguments for the environmental benefits of district heating come from the facts presented by independent experts. An undisputed expert authority regarding environmental protection, the Austrian Federal Environmental Protection Agency (Umweltbundesamt), compared the calculated greenhouse gas emissions of various forms of

energy in their report “Development of the Vienna Heating Market and the Resulting Environmental Effects”.

In addition, the emission of air pollutants (particulates, SO_2, NO_X, etc.) compares favourably for district heating. For this reason, development of district heating is also an important component of climate change programmes, climate change strategy and programmes for the reduction of particulate matter and other air pollutants.

The following diagram represents the benefits of using biomass in larger plants such as the new biomass CHP plant in Vienna.

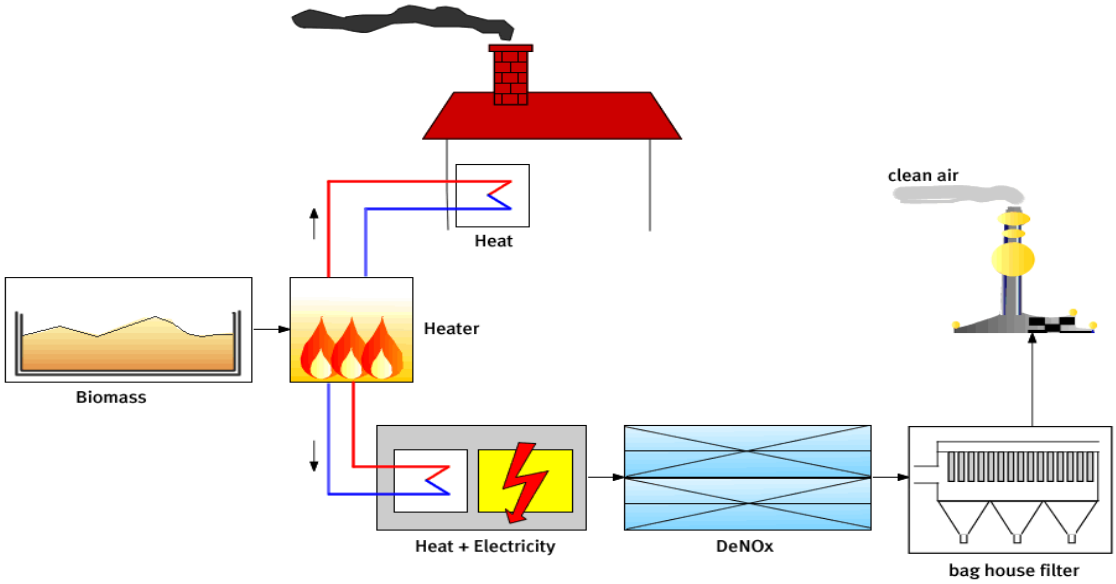


Illustration 3: Biomass CHP plant in Vienna

In one case, for example, biomass in pellet form is burned and used for heat only. Here, there are significantly higher emissions of air pollutants because the flue gas is not cleaned. High efficiency heat and power are produced in a biomass CHP plant with extensive effort aimed at flue gas purification.

4 Customers

Fernwärme Wien provides around 292,000 residential customers with heat, while also supplying 85% of these with hot water and serving 5,809 commercial customers as well.

A survey of Wien Energie Fernwärme customers in December 2008 showed high satisfaction ratings — 51% were “very satisfied”. In particular, security of supply, innovation and environmental friendliness were acknowledged while the value of the cost-performance ratio, transparency/price and the impression of billing statements were also viewed favourably.

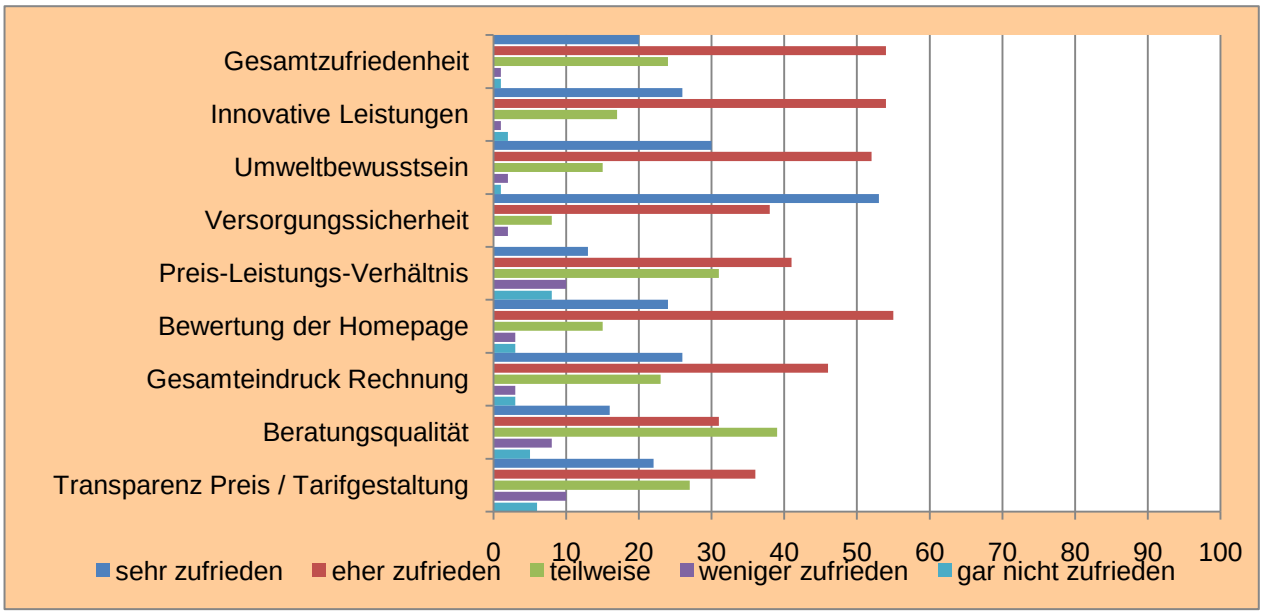


Illustration 4: Customer satisfaction 2008

Customer retention activities, aside from our position as a reliable partner for all eventualities, range from staging cultural events (free book campaigns, jazz festivals on the grounds of the incinerating plant and art presentations in the Fernwärme lobby) to classic customer loyalty incentives such as a customer card which provides Fernwärme customers with discounts for a diversity of events, tours through the waste incineration facility and various information campaigns.

5 Development of District heating

Expansion of district heating, which has a 37% market share today, will be pursued into the future. Fernwärme Wien already has a very large potential for waste heat utilisation and there are still more sources to take advantage of.

Currently, an existing CHP unit is being repowered, which will result in a high efficiency CHP plant providing approx. 100 MW of additional district heating capacity. Project planning includes a geothermal well that could provide up to 50 MW of additional heating power.

We will continue to follow the current path of fuel and technological diversification as well as the consistent use of existing waste heat potential. Production facilities have been developed to such an extent that a market share of 50% has been set as a customer expansion goal for Vienna by 2020.

The facts show that Fernwärme Wien has already accomplished quite a lot — the environmental audit speaks for itself! Since 1990, Fernwärme Wien has reduced CO_2 emissions from 168 kg/MWh to 130 kg/MWh, largely through the increased use of natural gas and CHP, and increases in plant efficiency.

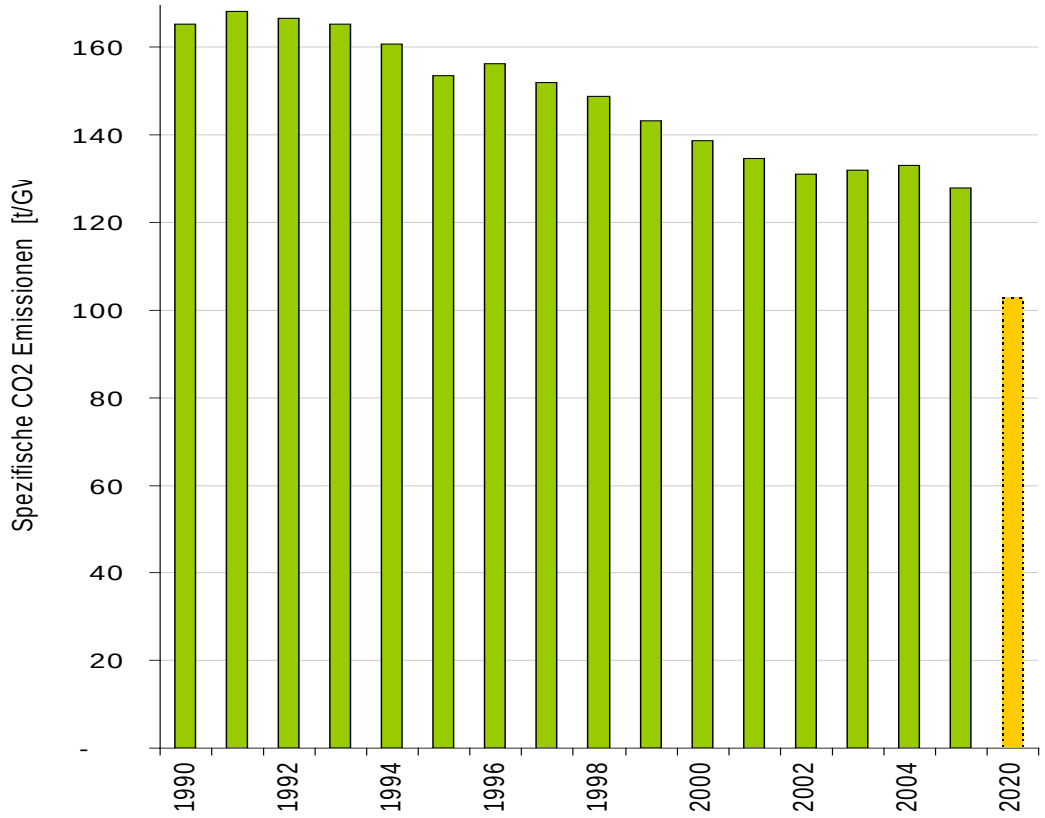


Illustration 5: Development of specific emissions from 1990 to 2005 including forecast for 2020

6 District cooling

6.1 Benefit of district cooling

Should climate change develop in line with the experts' ´predictions, then we must accept that we are living in a time of global warming. The amount of energy needed to satisfy demand for cooling buildings is set to exceed that required for heating them within the next 20 years. The system works in a similar way to how district heating operates.

The waste heat is either generated by co-generation plants or by thermal waste incineration. In the near future there will be also heat from a geo thermal plant. Compared to conventional cooling the consumption of primary energy is lower by a factor between four and ten. The

rise in demand for air conditioning leads to a substantial increase in requirements for electricity.

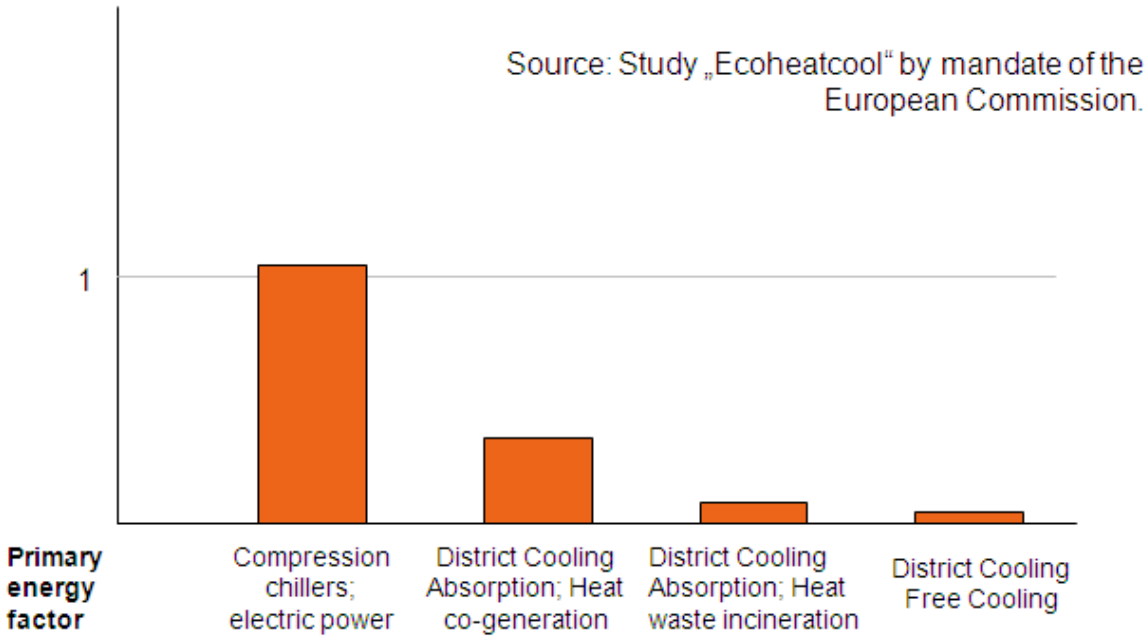


Illustration 6: Primary energy factor of different Cooling Systems

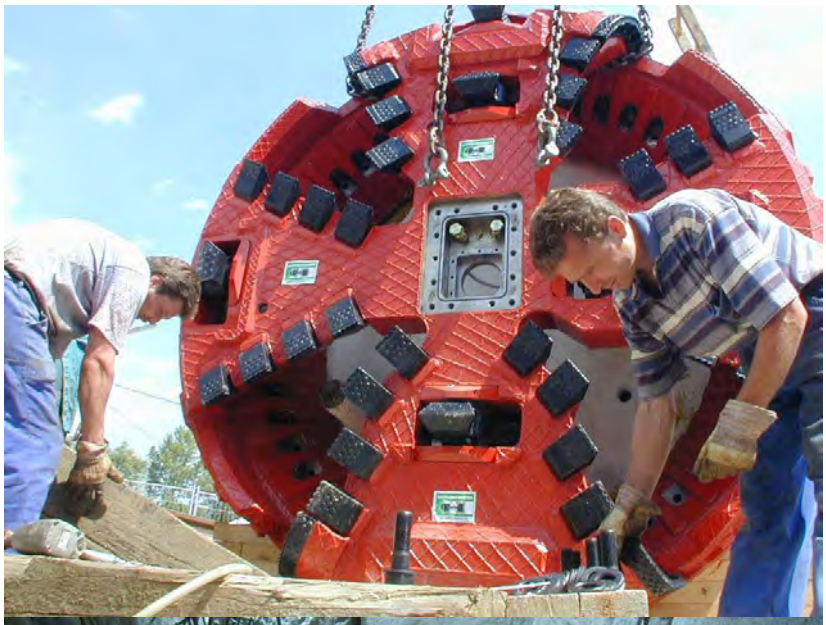
District Cooling from waste heat from thermal waste incineration is an environmentally friendly alternative that also spares resources. District Cooling from thermal waste incineration only needs a tenth of the energy in comparison with electric power and yields a manifold reduction in CO2-emissions.

6.2 Market and Performance District Cooling 2007/08

There are 7.8 MW in operation; a further 25.7 MW are currently under construction. Pilot project „Town Town" first stage 5.3 MW and 1 MW Free Cooling (second stage plus 3.1 MW). „Schwarzenbergplatz" with 1.2 MW and Sky-Line with 1.3 MW are completed. District Cooling centre under construction in the Spittelau plant. Cooling output 17 MW in the first stage and 50 MW in the final stage. Contracts signed with the General Hospital and the University of Agriculture (BOKU). Negotiations with Muthgasse and others. For example the new Central Train Station, which is under construction.

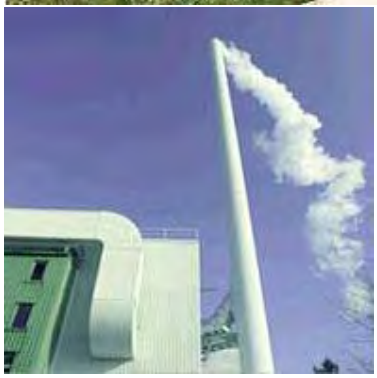
7 Annex

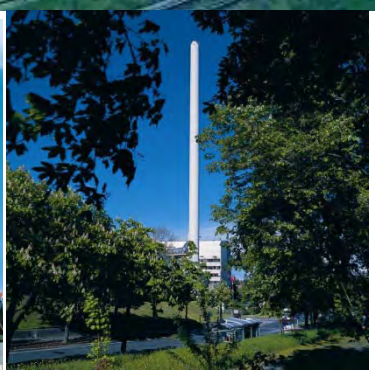
Pictures: District Heating









Pictures: District Cooling